DOCUMENT RESUME

ED 208 210 CE 030 324

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TITLE	Introduction to Teaching Adults. Module 10: Understanding the Learning Process.
INSTITUTION	British Columbia Univ., Vancouver. Center for Continuing Education.
SPONS AGENCY	British Columbia Dept. of Education, Victoria.
PUB DATE	81
NOTE	21p.; For related documents see CE 030 315-325.
AVAILABLE FROM	University of British Columbia, Centre for Continuing Education, 5997 Iona Dr., Vancouver, BC, V6T 2A4 ($40.00 per set, including cassettes, for Canadian residents; $110.00, plus postage and handling, for international orders; 10% discount on 10 or more sets).
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Adult Education; *Adult Educators; Adult Learning; Autoinstructional Aids; Behavioral Objectives; *Cognitive Processes; Continuing Education; Correspondence Study; *Learning; Learning Activities; Learning Modules; Learning Processes; Learning Theories; *Models; Outcomes of Education; *Teacher Education

ABSTRACT

This module on the learning process is the tenth of 11 modules in the set, Introduction to Teaching Adults. Designed to meet the learning needs of part-time continuing education instructors, these modules can be used as resource materials for local workshops or study-discussion groups, as self-instruction (each module takes approximately two hours), and as a correspondence course. (Source information on correspondence study is cited in module 1.) All modules except the first are designed to be used in part in conjunction with an audiotape. The module presents a general view of how people learn. It describes the information-processing model of learning, eight learning structures, eight learning processes, and five general types of learning outcomes. A review is provided. (YLB)

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INTRODUCTION TO TEACHING ADULTS

MODULE 10

UNDERSTANDING THE LEARNING PROCESS

Prepared by:
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Division of Adult Education
The Univeristy of British Columbia
1981

CE 030 324

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MODULE 10: UNDERSTANDING THE LEARNING PROCESS

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Under contract to:
The Continuing Education Division
Ministry of Education
835 Humboldt Street
Victoria, B.C., Canada V8V 2M4

Design, typesetting and layout:
the strait media group inc.

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MODULE 10

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ABOUT THIS PROGRAM

This series of modules was developed by the Division of Adult Education and the Centre for Continuing Education of the University of British Columbia under contract with the Ministry of Education of the Province of British Columbia. The series was developeu under the direction of Gary Dickinson, and Sandy McGechaen supervised the production.

The eleven modules in the complete program are:

Level I

1 Guidelines for Teachers of Adults

Level II

2 Using Instructional Techniques
3 Using Instructional Media
4 Using Evaluation Instruments

Level III

5 Designing Instruction
6 Writing Instructional Objectives
7 Managing Instruction
8 Enhancing Motivation

Level IV

9 Understanding the Adult as Learner
10 Understanding the Learning Process
11 Continuing Your Development

MODULE 10: THE LEARNING PROCESS

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INTRODUCTION

Module 9 looked at the nature of adult learners and discussed how their personalities influence their capacity to benefit from instruction. Learning was described as a set of internal processes that all human beings use to acquire or change their capabilities. This module presents a general view of how people learn. It describes the human mind as having eight **structures** that make it possible for eight **learning processes** to occur. Once this overall picture of learning is developed, five general types of **learning outcomes** are described. Each of these five types requires special emphasis on a few of the processes of learning. By the end of the module you should have an understanding of learning processes so that you can be an effective guide for adults' attempts to learn.

The booklet for this module describes learning structures, processes, and outcomes. There are review exercises at the end that you will be asked to complete when you have finished reading the booklet. The cassette discusses several important strategies that will enable you to aid the progress of adult learners through the learning processes outlined in the booklet. You should read the booklet and complete the exercises before listening to the tape.

In this module you will probably find a number of terms that you haven't seen before. Although you may experience some difficulty the first time you read the new terms, it is important that you try to understand them. These form a "language" for talking about learning and instruction just as there is a special language associated with any trade, profession, or hobby.

THE NATURE OF HUMAN LEARNING

What does it mean to learn? One answer to this question is that **learning is a more or less permanent change in human capability**, not directly attributable to natural physical growth. Another way of saying this is that learning refers to changes that result from experiences or external conditions. Changes that are internally influenced, such as physical development, are considered to be maturation. Total change in an individual results from the interaction of learning and maturation, but the changes that result from learning are the primary concern of instructors.

There are two general ways of looking at the structures and processes of learning. One is to look at learning as a series of habits that are acquired through practice. The emphasis in this approach is on rewards and punishments, and it concentrates on things happening in the external environment of the learner. As this view tends to focus on the external behavior of the learner, it is called **behaviorism.** Although it is helpful in explaining some aspects of learning, it does not say much about what goes on inside the learners.

A second general approach attempts to explain what internal processes and structures operate inside the learner. This is called **cognitive** learning theory. Cognitive refers to mental activities and not just a passive mental state with learning determined solely by practice and reward. One way of thinking about this cognitive approach is to consider the human mind as being similar to an information processing machine like a computer. Questions such as, Who programs it? How does it get programmed? Who does it respond to? can be asked to provide direction for aiding information processing. This module uses a cognitive or information processing model of learning.

Before we examine structures and processes of learning in the information processing model, let us be sure about the differences between physical growth or maturation and learning. Factors that influence maturation are to a large extent genetically determined, while the factors that influence learning are chiefly determined by events in the individual's environment. In a sense, maturation is a natural event. Learning is to some extent unnatural in that it is influenced by events in the social environment. All people, and teachers in particular, are part of the social environment, so they are in a position to influence learning. An information processing model of learning places the learner in an active position in the learning process, and views instructors as part of the external social environment capable of influencing the learner and the learning process.

THE INFORMATION PROCESSING MODEL OF LEARNING

The essential feature of an information processing model of learning is the view that learning involves many mental activities, not just habitual responses to external events. A great amount of complex decision-making goes on in the learner's mind. These mental decisions are about how information is acquired, modified, manipulated, used, and stored. Two basic assumptions are involved in the information processing model. First, that learning requires a **series of processes** or stages, and second, that there is a **limited capacity** for storage in the brain.

The process assumption is that there are stages in learning. **All learners employ the same stages no matter what learning task they are attempting.** A common series of events takes place between the time that the learner senses something in the environment and the time that the learner does something with it. The "something in the environment" (information) can be remarkably altered as it goes from one stage of processing to another. An understanding of the processes enables us to assist the passage of information through the various stages. As we will see later, there are eight processes or stages in learning.

The limited capacity assumption is that humans store information in various structures of the mind for different periods. In some of the structures, storage is limited in terms of the amount of information for a very short time. be stored without decay setting in. For example, our eyes and ears can hold a very limited amount of inforamtion for a very short time. Long-term memory, however, can hold a great deal of information for a long period. Knowledge about these storage centres and their limitations is useful to instructors when they attempt to aid the learning process. As we will now see, there are eight structures involved in learning.

STRUCTURES OF LEARNING

The eight structures that come into play in any learning task are described below, and Figure 1 shows their relationship with each other.

1. Receptors
Receptors are the physiological mechanisms which are capable of receiving information from the environment. These include the eyes, ears, nose, tongue, and touch receptors.

2. Sensory Registers
Various events and stimuli occurring in the environment activate the receptors, and this information is received in the sensory registers located in the brain. Stimulation is converted into impulses which register on the brain. Our sensory registers, connected with the receptors, can hold only a limited amount of information for a brief period.

3. Short-term Memory
If information received in the sensory registers is to be retained, it must be transformed and stored temporarily in the short-term memory. The capacity of short-term memory is limited to approximately seven items (about the length of a telephone number), and after about 20 seconds the information decays. It disappears and is lost unless it is transferred to long-term memory.

4. Long-term Memory
After information is coded or linked up with other information possessed by the learner, it is stored in the long-term memory. This structure has a much larger capacity than short-term memory, and it can retain information in storage for lengthy periods of time.

5. Response Generator
When the learner recognizes a situation in which previously learned material must be used, the basic form and pattern of the response is determined by the response generator. This structure determines such things as whether speech, small muscle movements, or other types of response are appropriate. It also determines the pattern or sequence of the response.

6. Effectors
Effectors are the muscles and bodily organs which exhibit the performance suggested by the response generator.

The two remaining structures involved in learning are termed executive control and expectancies. These structures reflect the lifetime of experiences of individual learners, and result in the formation of habits which are difficult to change.

7. Executive Control
Executive control is the learner's habitual way of processing information. Over a lifetime, adults have developed habits of listening, remembering, and thinking which are applied in every situation. These set ways of dealing with information are useful to the extent that they save the learner the trouble of developing new strategies everytime a new learning situation arises. They cause some difficulty, however, when the instructor wants to introduce new ways of dealing with information.

8. Expectancies
Expectancies are learners' attitudes about themselves and about objects or events in the environment, and thus they represent what learners expect of themselves and the environment. As with executive control, there is a wide range of individual differences in expectancies among adults.

Before going on to read about the processes of learning, it might be useful to re-read the section on structures and study Figure 1. Think about something simple you have learned recently, and trace how it would have progressed through the eight structures described here. It might help if you did this out loud — provided that no one is watching you!

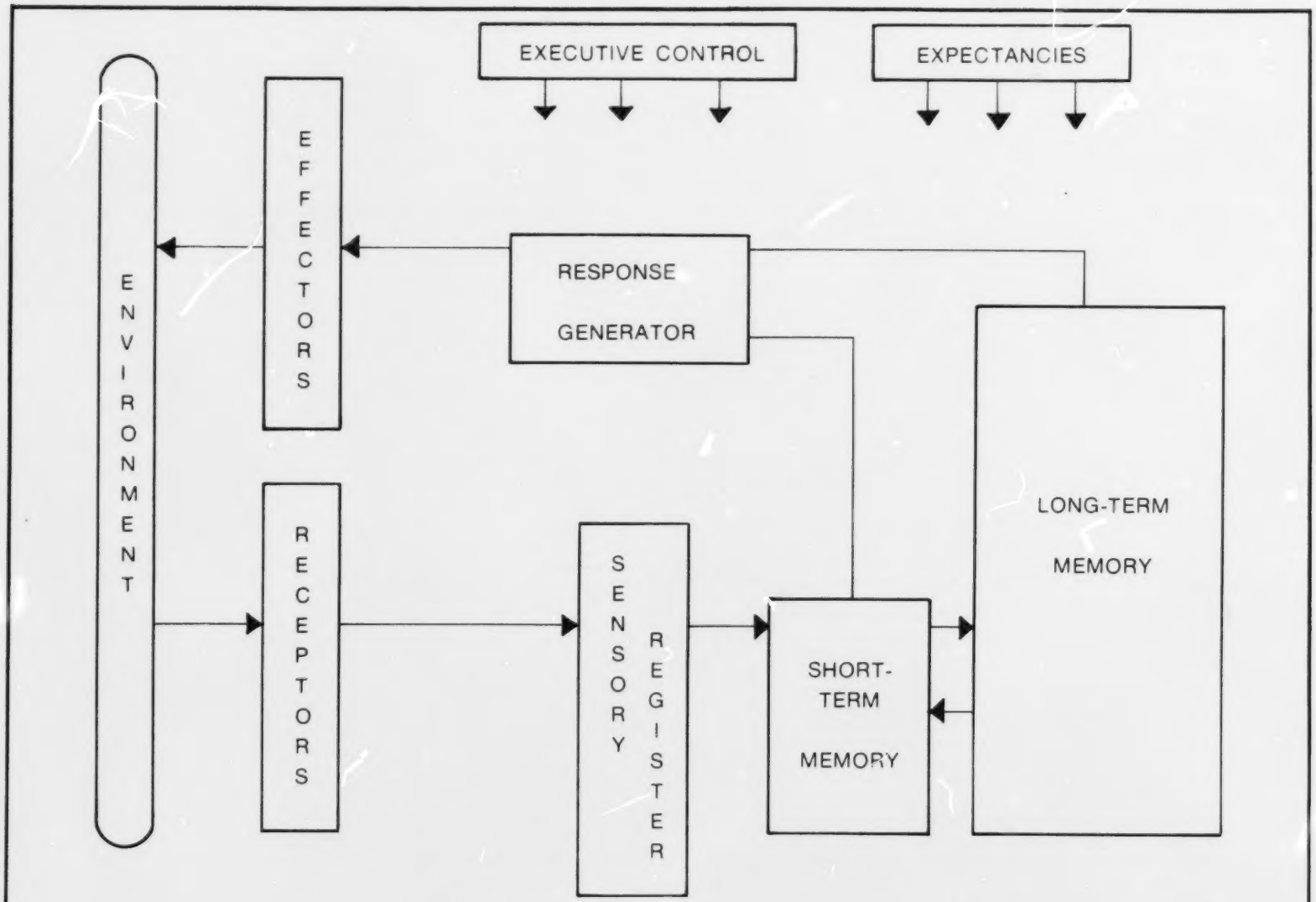


Figure 1

STRUCTURES FOR LEARNING

PROCESSES OF LEARNING

There are eight stages of learning that occur as a human being attempts to learn something new. Although learners may go through these stages somewhat differently due to their unique executive control and expectancies, there are still certain aspects of learning that are universal for all human learners. These are called learning processes. If we can understand these general processes, we can then be concerned with the particular way each learner uses the processes. Robert Gagne suggests that there are eight stages or processes of learning. (See Figure 2.)

1. Motivation

This process of learning involves the development or activation of expectations on the part of the learner about what he or she will get out of the learning effort. It is the incentive that will carry the learner through the following seven processes of learning. If motivation exists, it is merely a matter of activating it by some event in the environment. A brief comment by the instructor could be sufficient to activate motivation. If incentive does not exist, that is, the potential learner does not have any positive expectations regarding the learning, then motivation must be established rather than simply activated. Sometimes this may be done by communicating to the learner the rewards that can be won by achieving a given learning task. At other times it must be demonstrated to the learner, either by example or by direct experience, how desirable it is to achieve a given learning task. The activation or establishment of motivation does not itself ensure learning, it merely prepares the way for the learning that follows. It is, however, an essential first step. Module 8 - Enhancing Motivation deals with the topic of motivation in greater detail.

2. Attention

Paying attention has two dimensions. First, an event or stimulus must be available in the environment for the learner to attend to. Whatever the event is, it must be flowing past one or more sensory registers. Second, as the information flows by, the learner selects certain aspects of the stimulus and enters them through the sensory register into the short-term memory. The time the original stimulus is available for attention and selective processing is incredibly brief. A stimulus is erased in a matter of seconds if it is not selected for processing. This rapid decay feature is necessary because without it we would be dealing with overlapping images in our sensory registers with chaotic results. We would be flooded with information that couldn't be handled.

The dual nature of the attention process is first to attend to the stimulus as it passes by the sensory register and second to select certain aspects of the stimulus to store in the short-term memory. For instance, as you read this page you will be looking at the structure of the sentences in order to determine their meaning. You will probably not be paying attention to unimportant aspects such as the style of the print or the arrangement of the page. When you are teaching, concentrate on the things you can do to help the learner "see" the relevant parts of the stimulus and to ignore the irrelevant aspects.

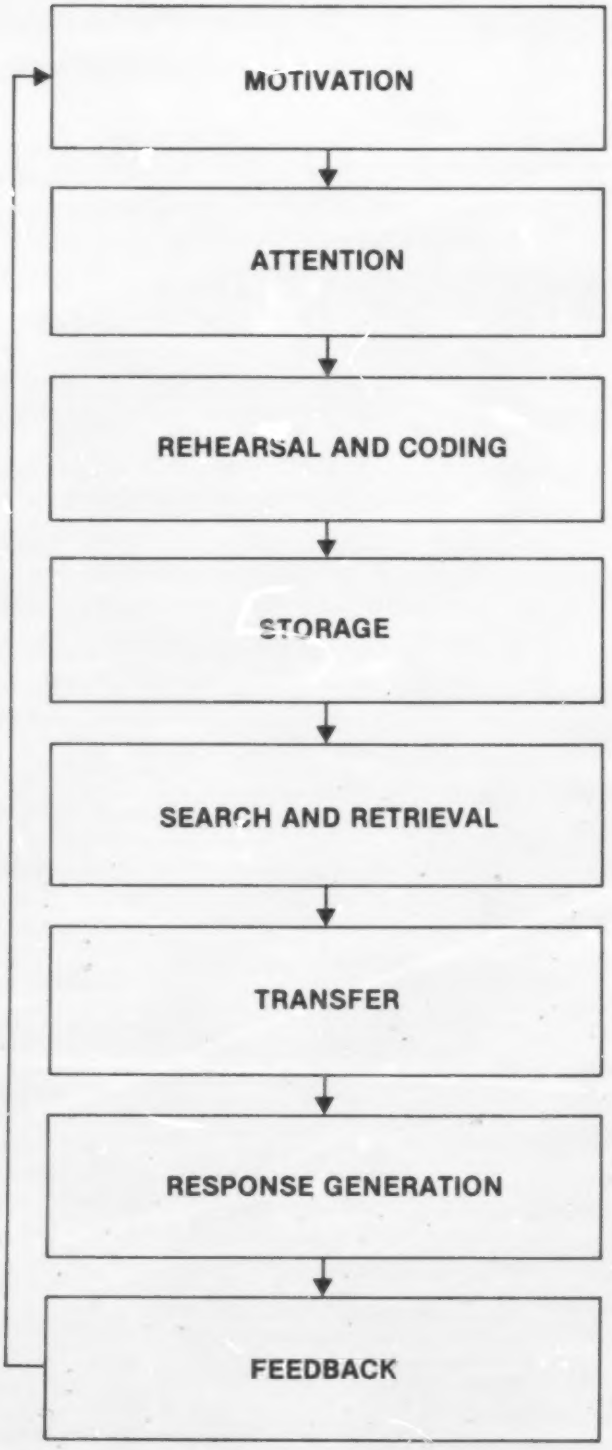
3. Rehearsal and Coding

This process occurs in the short-term memory. The information to be learned flowed past the sensory registers for a brief moment in its true form. Selective perception operated on the information passing through the sensory register and changed the material to be learned into something more specific. For instance, if you were learning a telephone number from the directory, one particular number would be selected from a group of numbers passing by the visual sensory register. The particular number to be learned would be selected and passed to the short-term memory for coding.

The coding process involves hooking the new information to previously learned information already in long-term storage. This search for meaning takes time and creates a problem because the short-term memory has a limited capacity. By means of rehearsal or repetition, the information can be maintained in short-

Figure 2

LEARNING PROCESSES



term memory for longer periods to enable coding to occur.

Although individual learners have their own coding strategies, it is generally thought that people code information in **sentences, images,** or **episodes.** For example, if you were coding the eight processes of learning you could put them into sentence form and memorize them. Alternatively, you might visualize the eight processes as points on a circle. Finally, you could learn them in the context of a skit in which the sequence of learning processes is demonstrated. Each of those three — sentences, images, or episodes — are ways of getting information into long-term memory.

The way in which learners code information can be efficient or inefficient for the purpose at hand. The thing to remember with adults is that their coding strategies are acquired over a lifetime and tend to be frozen into habitual patterns. Any attempt to change them will involve an unfreezing of old habits before new ones can be acquired.

4. Storage

When information has been coded it is stored in long-term memory. Some authorities suggest that once information is coded and stored, it is never lost through time. What can occur is problems of remembering or retrieval caused by the way in which the information was originally coded. Little is known about the storage process other than the suggestion that things may happen while information is in storage that may result in its not being recalled later. In many cases, information cannot be recalled because the material is interfered with by previous or subsequent learning. You should do what you can, then, to make sure that new material has distinctive features so that it won't become confused with other material in storage.

5. Search and Retrieval

At this stage of learning, information has been coded and stored in long-term memory. If the information can be searched for and retrieved successfully, you can verify that learning has occurred. It is generally thought that **cues** are used to aid in the search and retrieval of material in storage. Often what is retrieved is

returned to the short-term memory and combined with other information to form new items. In other cases, information is searched and retrieved directly to the response generator without being brought to the short-term memory. An example of this would be the recall of a familiar telephone number which is dialed immediately.

6. Transfer

The critical aspect of this stage of learning is **generalization** of the learning that has occurred. This recall of what has been learned and its application to new and different situations is called the transfer of learning. For example, if a learner acquired the capability of typing on one model of typewriter, the skill should be transferable to other kinds of typewriters. The capacity to make this transfer is thought to involve additional working rules which assist the learner in making the transfer, and which can be taught by the instructor. Learning for transfer means acquiring processes of retrieval that will apply in many kinds of pratical situations. As you can see, transfer is really the practical application of a learned capacity that has been demonstrated during the search and retrieval process. The instructor encourages transfer by giving the learner opportunities to apply new material in a variety of different situations.

7. Response Generation

This is the stage of learning where the learner performs the task according to some standard and with no prompting from the instructor. By exhibiting the learned performance, learners are assured that they have learned it. The response verifies that learning has taken place.

8. Feedback

For the learning process to conclude, the learner must receive information that the performance has met expectations. Learning begins with some expectancy on the learner's part during the motivation process. The confirmation of this expectancy through feedback closes the learning for a particular learning task and provides a basis for the learner to proceed to the next learning task.

Although the processes of learning have been presented as a step-by-step sequence, the actual operation of these processes often involves recycling at various stages. For instance, if during the search and retrieval stage a learner cannot recall the information, it is necessary to go back and code the information again. Similarly, a learner may be unable to transfer a skill and must go back and code before transfer can be accomplished. In some situations the learner may run out of motivation, so it would be necessary to return to the first process of learning.

At this point, it would be helpful if you would review this section on learning processes, and study Figure 2. When you have done this, think again about something you have learned recently. Trace your learning through the eight stages described in this section.

TYPES OF LEARNING OUTCOMES

This module has described eight processes of learning involved in every learning task. By **learning task** we mean a separate action to be learned. Several tasks are necessary to complete a more complex objective.

The countless learning tasks in any subject can be reduced to a manageable number of basic types. Robert Gagne has identified five basic types of learning outcomes; **verbal information, intellectual skills, cognitive strategies, attitudes,** and **motor skills.** He maintains that the key to understanding learning is in these five basic types of capabilities and not the nature of the subject matter. The reasoning behind this is:

1. Learning is not unique to subject matter. There is no sound basis for "plumbing learning", "carpentry learning," "dental technician learning", or "secretarial science learning".

2. The same variety of learning outcomes occurs in different vocations. One must learn how to calculate measurements whether they are for door frames or interest rates.

3. In addition, different types of learning outcomes occur within the same vocation. In masonry one must not only be capable of calculating the mix of ingredients for mortar but also for visualizing the bond and spreading the mortar.

If we accept this reasoning, then the responsibility of understanding learning will be more manageable. Instead of having to know how to teach a great number of learning tasks, we can deal with five general types of learning outcomes, each of which has different requirements for instruction.

1. Verbal Information

This type of learning outcome is a person's ability to say, write or otherwise use information in a sentence. Examples would be listing the basic tools of the auto mechanic or giving dates for historical events. Large amounts of this verbal information are required by individuals during their lifetime. Because verbal information is usually brand new information, it is often difficult for the learner to pay attention to it. We tend to see the things that are familiar to us and ignore things that are unfamiliar. How many times have you discovered a new word and then realized it had been in several places you hadn't noticed before? Not only is verbal information difficult to notice, it is also a bit difficult to link up (code) to something we already know. The two learning processes of selective perception and coding are the special features of learning verbal information to which the instructor must give particular attention.

2. Intellectual Skills

These can be thought of as mental skills. They are involved whenever you perform an activity that requires mental processing such as distinguishing varieties of objects, forming classifications, or applying the rules of language and mathematics. In the case of the bricklayer, an intellectual skill would be calculating the amounts of ingredients necessary to mix a quality of mortar sufficient for a particular job. One characteristic of this type of learning outcome is that it usually requires prior skills. Thus, to calculate the amounts of ingredients for mortar, the bricklayer would have to know what ingredients were involved, to recognize them when seen, to state the formula, to substitute the formula in the correct proportions for the amount needed, and so on. The special processes of learning involved in intellectual skills are the recall of previously learned capabilities necessary for the performance of the skill and the transfer of the abstract skill to a specific situation.

3. Cognitive Strategies

Over an individual's lifetime, habits of attending, coding, remembering, and thinking are developed. These habits represent the person's experience of "learning how to learn". Cognitive strategy learning outcomes are those

objectives which are novel to the learner. The learner has no prescribed set of rules for solving a problem but instead must develop a new strategy for solving it. This human capability is highly prized and is built upon the individual's accummulated verbal information and intellectual skills. The special feature of learning cognitive strategies is the transfer of all previous learning to a new problem. Typical examples of cognitive strategy learning outcomes are trouble-shooting problems. For example, a mechanic arrives in the field with a limited number of tools and is able to improvise by converting specific tools to other uses as required in order to repair a piece of machinery.

4. Motor Skills

Motor skills involve muscular activity and have some direct impact on objects in the environment. This impact is accomplished by a total action that is smooth, regular, and precisely timed. The action is composed of a series of separate movements, but it is difficult to recognize them as separate movements because of their smoothness. The procedure for these movements is called the **executive subroutine.** The ability to pitch a baseball accurately is an example of a motor skill, with winding up, checking first base, and toeing the mound being parts of the executive subroutine of pitching the ball. In carpentry, planing the edge of a board would constitute a motor skill. The special features of learning involved here are the difficulty in recognizing the executive subroutine and the need for immediate correction of any errors. If the wrong habits are acquired, it is much more difficult to correct this mislearning than in other types of learning outcomes. The instructor should make sure that the correct movements are practiced from the beginning.

5. Attitudes

An attitude is a learned tendency that influences the choice of personal action toward things, events, or persons. This tendency is composed of knowledge and feelings of like or dislike which combine to produce the readiness to move toward or away from some object. Getting automobile drivers to prefer to use their seat belts is an example of an attitudinal type of learning outcome. Notice that this is quite a different outcome than either knowing when to wear a seat belt or how to adjust one. Attitudes often involve some behavior, so the capabilities appropriate to that behavior must be available to the learner. Learning an attitude is not unlike developing motivation. The special feature of learning attitudes is the existence of the possibility of reward when the preferred behavior is present.

The following page lists 17 learning outcomes. To give you some practice on the intellectual skill of classifying learning outcomes, indicate which of the five types of learning outcomes is represented by each item.

EXERCISE 1

Below are listed learning outcomes which were drawn from many different types of courses. For each one, identify the type of learning outcome. An example is given. The answers are on the next page for you to check your work.

	Learning Outcome	**Type**
Ex.	Diaper a baby.	Motor Skill
1.	Select the appropriate iron and solder.	_____
2.	Remove filter assembly.	_____
3.	Prefer to use seat belts.	_____
4.	List main check points for pruning a tree.	_____
5.	Shape a tree to the desired crown.	_____
6.	Discuss proposed hair styles with client and obtain agreement.	_____
7.	Decide whether to adjust, clean, or replace spark plugs.	_____
8.	Keep a daily record of sales and inventory.	_____
9.	Develop a system for colour-coding course handouts.	_____
10.	Choose to teach adults rather than children.	_____
11.	Identify a joint to be soldered.	_____
12.	Place soldering iron on a joint.	_____
13.	Show pride in personal appearance.	_____
14.	Dress appropriately for a special occasion.	_____
15.	List the basic food groups.	_____
16.	Explain how the basic food groups meet nutritional requirements.	_____
17.	Prefer to prepare meals containing each of the basic food groups.	_____

ANSWERS

	Type
1.	Intellectual Skill
2.	Intellectual Skill
3.	Attitude
4.	Verbal Information
5.	Motor Skill
6.	Intellectual Skill
7.	Intellectual Skill
8.	Intellectual Skill
9.	Cognitive Strategy
10.	Attitude
11.	Intellectual Skill
12.	Motor Skill
13.	Attitude
14.	Intellectual Skill
15.	Verbal Information
16.	Intellectual Skill
17.	Attitude

CONCLUSION

Learning is an eight-stage process, and learning outcomes can be classified into five categories found in any subject area. Different stages of the learning process need to be emphasized for different types of learning outcomes.

Throughout this module we have made an assumption that people learn small "bits" which add up to wholes, and that each bit is learned by passing it through the eight stages of learning. This is not entirely true because people sometimes learn through insight. That is, they manipulate all of the bits at the same time and suddenly have an "ah hah" experience. This kind of insightful or discovery learning is what we referred to as cognitive strategies. An instructor can aid discovery learning by not presenting all of the learning as small bits. Thus, the system of understanding learning that has been discussed here can incorporate both guided learning and discovery learning.

ASSIGNMENT

Your responses to the following questions may be submitted on paper, or you may record them on a blank cassette.

1. Consider the course you are now teaching or will soon be teaching. Make a list of ten to fifteen outcomes that will be included in the course, then classify each learning outcome by type.

2. Take two of the learning outcomes identified in question 1 and describe what you would do in each case to help learners move through the eight processes of learning.